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THE AUTOMATA IN THE BYZANTINE "THRONE OF SOLOMON"

By GERARD BRETT

THE first part of ii, 15 of the *De Ceremoniis* describes the reception in the Great Triclinium of the Magnaura when a foreign legate visits Byzantium. The title describes it as taking place with the emperor seated *ἐπὶ τοῦ Σολομωντείου θρόνου·*. The name implies that this was a special throne, in keeping with Solomon's position in tenth-century imperial theory, and the text confirms that there were a number of particular features in it, some of which are my subject here. After dealing with the preparation of the emperor and the court, it passes on to the ceremony, and here this sentence occurs[1] *καὶ ποιοῦντος τοῦ λογοθέτου τὰς συνήθεις ἐρωτήσεις εἰς αὐτόν, ἄρχονται βρυχᾶσθαι οἱ λέοντες καὶ τὰ ὄρνεα τὰ ἐν τῷ σέντζῳ ὁμοίως καὶ τά ἐν τοῖς δένδρεσι, ᾄδειν ἐναρμονίως· τὰ δὲ ζῶα τὰ ἐν τῷ θρόνῳ ἀπὸ τῶν ἰδίων βαθμῶν ἀνορθοῦνται.*

To the writer of the *De Ceremoniis*, the important point was the moment in the ceremony at which these movements and sounds took place; to us the automata themselves are of more interest than the occasion of their use. Three are mentioned, the tree or trees and the singing birds — that the birds "in the throne" were distinct from those "in the trees" seems unlikely — the roaring lions, and the moving beasts. I omit as outside the scope of this paper both the water-organs and the movements of the throne; the former mentioned in the passage, but not at this point, the latter not in the *De Ceremoniis*. Of the automata proper, the birds are described only as being "in the throne and in the trees," the lions not at all, and the beasts only as *ζῶα* or (later) *θηρία*. Nothing is said about the material or mechanism of any of them, nor is there anything about the trees. My purpose is to examine these automata, their nature, origin, and history.

First, then, we must note that the *De Ceremoniis* is confirmed by the almost contemporary Liutprand of Cremona,[2] who visited Byzantium as an envoy in 948 and again in 966. He was received in what he calls the "Megaura quasi Magna Aura," and about the automata says first that "Aerea sed deaurata quaedam arbor ante Imperatoris oculos stabat, cujus ramos itidem aereae diversi generis deaurataeque volucres replebant, quae secundum species suas diversarum avium voces emittebant." Liutprand adds little to what the *De Ceremoniis* says. He speaks of only one tree, which is in line with all other evidence; he tells us this whole automaton was of metal. When he comes to describe the beasts he mentions only the lions, in a passage I quote later in this paper. He also makes a significant query about one piece of the mechanism. He does not answer it, but it is significant because no one else seems even to have recognized the problem's existence. Indeed, although the singing birds in particular struck the mediaeval imagination very strongly, no Byzantine writer describes how they worked: the question is only recognized after the knowledge of the automata had passed outside the Byzantine world.

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[1] *De Ceremoniis*, ii, 15, Bonn edition, p. 566 f.

[2] Book vi, Ch. 2; L. A. Muratori, *Rerum Italicarum Scriptores* (1672–), ii, 469–470.

First, then, this automaton of the singing birds. The presence of the birds in the tree is a grafting of a Hellenistic invention on to the age-old symbolic image of the Tree.[3] This is perhaps Oriental in origin — it appears in the Gilgamesh legend, though at an uncertain date — but there are many much later examples, of which the Persian trees mentioned by Herodotus are the most famous. The grafting and adaptation to it of the automaton of the singing birds round the pool may be either Byzantine or Abbasid. The automaton itself is earlier than either, and various versions of it are described by Philo and by Heron of Alexandria. Neither can claim to have originated it, for Vitruvius, in speaking of the work of their predecessor Ctesibios, says that "Plures et variis generibus ab eo liquoris pressionibus coacto spiritu efferre ab natura mutuatos effectus ostenditur, uti merularum aquae motu voces. . . . "[4] However, the only detailed explanations we have are given in the *Pneumatica* of Philo and again in the later *Pneumatica* of Heron. The text of both has been altered by later editors and copyists, and there is a great deal of parallelism between them; my descriptions are based on Heron, generally the clearer text, and I refer to the many passages where Philo is parallel. The principle throughout is that air forced out of an air-tight compartment through a narrow orifice can be used to make a special sound; the method is the introduction of water. One of Heron's experiments puts this as simply as possible into practice.[5] Water flows into a vase and from it into an air-tight base. The air escapes from this as the water pours in, through a narrow pipe which rests on the rim of a second vase (Fig. 1). Like the other experiments this is illustrated, and on the rim of the second vase is a bird, sitting a little way from the pipe. The presence of the bird, as well as the general similarity, suggests that this actual automaton is the subject of a fresco in a house in Pompeii (Fig. 2).[6] There is a round basin, rather like a bird bath, with two birds on the rim, and four trumpet-ended pipes which come out of the water, curve over, and end level with the rim and outside it. This seems to follow Heron, but the method of driving the air through the pipes is not at all clear, and may not have been understood by the artist.

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[3] This is discussed by Paul Jacobstahl, *Ornamente griechischer Vasen* (1927), pp. 102 f.

[4] Vitruvius, x, 7, 4.

[5] *Heronis Pneumatica*, ed. W. Schmidt (1897), pp. 1, 15; A. G. Drachmann, *Ktesibios, Philo and Heron* (1948), p. 64.

[6] A reconstructed version of this, from which Fig. 2 is taken, is given by F. M. Feldhaus, *Die Technik der Antike und des Mittelalters* (1931), p. 176 and fig. 203. The original in its present state is reproduced in P. Grimal, *Les Jardins romains*, in *Bibliothèque des Écoles Françaises d'Athènes et de Rome*, CLV (1943), pl. iv, p. 4; see also p. 480 and fig. 31. The bearing of this on the question of the date of Heron is obvious.

The next automaton[7] is considerably more elaborate. Heron begins by pointing out that different bird songs can be produced by different sizes of pipes, and that the birds can be placed by a spring, a grotto or elsewhere. The essential is that there should be running water:

> *κατασκευάζεται οὖν ἐν κρήνῃ ἤ ἐν ἄντρῳ ἤ καθόλου*
> *ὅπου ἐπίρρυτον ὕδωρ ἔστιν*

Here again (Fig. 3) water flows into a vase round which birds are sitting and thence into an air-tight base. As before, the air escapes from the base through pipes which here come out at the birds' beaks, and thus makes them sing. The water passes through the base into a bucket below, held in position by a counterweight. The inflow into and outflow from base and bucket are so regulated that when the former is empty — thus stopping the outflow of air and with it the song of the birds, the latter is full — causing the bucket to drop, and so turning an owl towards the birds. It thus appears to be the turning of the owl that silences the song. When the bucket is empty, it and the owl revert to their original position; meanwhile the base is filling, and with the renewed inflow of water the escape of air makes the birds sing again.[8]

Later chapters repeat elements of both these. In one (Fig. 4)[9] water flows into a bucket which tips into a vase, and so once again into an air-tight base. The air, escaping from this as before, makes a bird seated on the base sing; the water runs out from the bottom of the base. In a more elaborate version of the same (Fig. 5)[10] the base is divided horizontally into four sections, and although Heron fails to say so, we must assume he means that from each compartment a pipe allows the escaping air to make a bird seated on a branch above the base sing. Only by this interpretation can all four birds sing at the same time. Heron mentions other pieces of apparatus which depend on this same principle of the use of air escaping from a closed compartment as it is filled by water. The only one at all related to these in purpose is a variation using steam (Fig. 6).[11] A vessel is made with an inner container filled with coals, and the burning of these heats water in the vessel itself. This causes an escape of steam, which a pipe carries to a triton with a horn and a singing bird which sit on the top of the vessel.

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[7] Heron, i, 16; Philo, c. 61. Drachmann, *op. cit.*, pp. 64 f., 114 f.

[8] I describe here what is probably the original mechanism of owl and bucket. In the Arab development of it the bucket tips automatically at a certain point, and in doing so pulls the rope which turns the owl. It remains tipped over until it is empty, when it and the owl revert together. See Ingebord Hammer-Jensen, *Neue Jbhr. für klass. Alterthum,* xxv (1910), pp. 482–483.

[9] Heron, ii, 4; Philo, c. 60. Drachmann, *op. cit.*, pp. 64 f., 116.

[10] Heron, ii, 5; Drachmann, *ibid.*, and p. 165.

[11] Heron, ii, 34–35; Drachmann, *op. cit.*, pp. 126 f., 166.

There is considerable evidence of both Arab and Byzantine study of all the Hellenistic technical writers, but particularly of Heron,[12] whose most popular works were the *Pneumatica* and the *Automata*. Tzetzes,[13] writing in the twelfth century, speaks of

ἕτερα βιβλία
’Εξ ὥν Ἥρων, ’Ανθέμιος καὶ πᾶς μηχανογράφης
Τὰ ὑδρικὰ τὲ ἔγραψαν καὶ τὰ πνευματικά δε

and the list of writers influenced by Heron is a long one. It includes the so-called Heron the Younger, or Heron of Byzantium, whose book is dated 938 and consists of a γεωδασία and a πολιορκητικά both based closely on Heron.[14] About one hundred Greek Heron codices with illustrative diagrams survive today to show his popularity, most of them dating from the Renaissance; to this period the first surviving Latin translations belong — the earliest of all is that of Valla, published in 1501 — although the later Latin dependence on him is as great as the Greek. It is occasionally expressed in practical form, for instance in the singing birds and owl which Montaigne saw in the garden of the Villa d'Este at Tivoli.[15] The earliest surviving Greek text is in Marciana cod. gr. 516, probably of the thirteenth century.[16] Evidence of Arab study of Heron begins in Abbasid Baghdad during the ninth century. At least four codices contain Arabic translations of the *Mechanica*, the chief one, by Kosta Ben Luka of Baalbek, made on the orders of the Abbasid Caliph al-Motassim, 862–66. There are also Arabic works based on, though not translating, Heron. Of these the "Work on Clever Arrangements in relation to Works of Art" of the Benu Musa is a ninth-century example.[17] The *Pneumatica* especially seems to have appealed to the Arab outlook, and the Egyptian "Abridgement of Wonders" draws heavily on it,[18] as — in part — does al-Jazari's "Book of the Knowledge of Ingenious Geometrical Contrivances," written early in the thirteenth century.[19]

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[12] Pauly-Wissowa, VIII, 1041–42, 1069 f., 1097. The effects of later study on Philo's *Pneumatica* are discussed by Hammer-Jensen, *op. cit.*, pp. 414, 417.

[13] *Chiliades*, ii, 150; ix, 972.

[14] Pauly-Wissowa, VIII, 1074.

[15] Montaigne, *Journal de Voyage*, ed. Lautrey (1906), pp. 269 f. See also A. Chapuis and E. Droz, *Les Automates* (1949), p. 43; an automaton of the owl and the birds is said *ibid.* to have been made by Salomon de Caus. The Valla translation, *De Expetendis et Fugiendis Rebus*, was published at Venice in 1501. The latest reflection of this tradition I have come across is in Section VII of Thomas Nashe's *The Unfortunate Traveller*, published in 1594. Here the mechanism in its later form is described in great detail.

[16] Kurt Weitzmann, "The Greek Sources of Islamic Scientific Illustrations," *Archaeologia Orientalia in Memoriam Ernst Herzfeld* (1952), p. 248 and note 13; L. Gasiorowski, *Malarstwo Miniaturowe Grecko-Rzymskie* (1928), pp. 173 f. and xxiv f.

[17] E. Wiedemann and F. Hauser, *Der Islam*, VIII (1918), 55; Chapuis-Droz, *op. cit.*, p. 38.

[18] Berthelot, *Journal des Savants*, May 1899, pp. 271 f.

[19] A. Coomaraswamy, *The Treatise of al-Jazari on Automata*, in *Museum of Fine Arts, Boston, Communications to the Trustees*, VI (1924), *passim*; Rudolph M. Riefstahl, "The Date and Provenance of the Automata Miniatures," *Art Bulletin*, XI (1929), 206 f.; Weitzmann, *ibid.*, pp. 249 f. The parallelism of conception is brought out most clearly in the apparatus for washing and drying after meals illustrated by Wiedemann and Hauser, *Archiv für Geschichte der Medizin*, XI (1919), 22 f., nos. 3 and 10, figs. 7 and 17; see also Riefstahl, fig. 6.

The few accounts we have of actual examples of a tree with birds singing, either Arab or Byzantine, must be considered in the light of this evidence of Heron's popularity. It can never be proved conclusively that the inspiration comes from him, nor do such accounts as we have ever correspond exactly to any of his descriptions. The chief difference has already been mentioned — that the later accounts always stress the tree, which could never have been part of any of Heron's automata. But considering the similarity of the effects sought to those achieved, we may assert with great probability that the latter all stem from one source, and that the basis of that source is, in part, the Heronic text.

Of these actual examples, the first to be mentioned is the series of "Fountains of Life" described by Strzygowski in another connection.[20] All of these bear some resemblance to various automata of Heron's, the singing birds among them, and they are mentioned here because the suggestion has been made[21] that that is where their original inspiration lay. For lack of any textual description, however, it is impossible to say if these were ever more than sculptor's or illuminator's designs. Otherwise the earliest Byzantine evidence concerns the Emperor Theophilus and his son and successor Michael II. There are two stories about this and Theophilus' other automata, both of them confined to the barest outlines. The first is told by the ninth century Georgius Monachus, who seems to have been very nearly a contemporary of Theophilus, and by two tenth century sources—Leo Grammaticus, whose account is word for word the same, and Symeon Magister who makes one significant addition.[22] Georgius Monachus says that *κατασκεύασε διὰ τοῦ ἄρχοντος τοῦ χρυσοχόοῦ, λογιωτάτου πάνυ ὄντος καὶ συγγενοῦς Ἀντωνίου πατριάρχου, . . . δένδρον τε χρυσοῦν, ἐν ᾧ σθρουθοὶ ἐφεζόμενοι διὰ μηχανῆς τινὸς μουσικῶς ἐκελάδουν.* Various points here are to be noticed. The tree is described as of gold, and reference is made to the bird song and its mechanical origin. Further, the tree is referred to simply as *δένδρον*, and the identity of the maker is given, though he is not named. Leo's account is the same; Symeon omits the reference to the maker, but adds that it worked *διὰ μηχανῆς ρινὸς . . . τοῦ πνεύμαέος διὰ κρυφίων πόρων εἰςπεμπομένου.* The second story is told by the tenth-century Continuator of Theophanes,[23] and copied from him by several later writers. This refers not to Theophilus but to Michael II, and says that, owing to a shortage of money for paying the army, Michael caused to be melted down various pieces of the imperial furniture, and of the automata of Theophilus, including *τήν τε χρυσῆν ἐκείνην καὶ πολυθρόλητον πλάτανον καὶ τοὺς δύο χρυσοῦς λέοντας, πρὸς δὲ καὶ τοὺς δύο γρῦπας ὁλοχρύσους ὄντας καὶ σφυρηλάτους.* The lions and gryphons we shall deal with later. Here we must note that neither birds nor mechanism are mentioned at all. The stress is on the tree, and it is described as *πλάτανος*, the first Byzantine reference to a plane, and clearly a mental reversion to the older tree image; the tree described by Herodotus,[24] that stood in the citadel of Susa until 316 B.C., was a golden plane. The later writers who follow the Continuator here (though none of them includes the reference to army pay) are Cedrenus, Zonaras, Glycas, and Constantine Manasses,[25] all at least of the twelfth century, the first two perhaps of the thirteenth. All of them use the word *πλάτανος* instead of *δένδρον*, and bring in the lions and gryphons but not the birds. Cedrenus and Zonaras expand the Continuator's single word "famous," referring to the tree, into *καὶ ἕτερα ἔργα, δι' ὧν ἡ Ρωμαίων ἐθαμάζεται βασιλεία* (Cedrenus). Constantine Manasses adds another to our meagre list of personal names: Theophilus' clock, another of the pieces melted down, was made by *μυριομαθιοτάτος ἐν φιλοσόφοις Λἐων*.

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[20] J. Strzygowski, *Römische Mittheilungen*, xviii (1903), p. 85.

[21] Pauly-Wissowa, viii, 1070.

[22] Georgius Monachus, Bonn edition, p. 793; Leo Grammaticus, Bonn edition, p. 215; Symeon Magister, Bonn edition, p. 627.

[23] Theophanes Continuatus, Bonn edition, p. 173.

[24] Herodotus, vii, 27; ed. G. Rawlinson (1860), iv, p. 30 and note 8.

Thus, of the two stories referring to the ninth century, one mentions the singing birds only, the other the lions, the gryphons and the plane but not the birds. One is almost contemporary with the events it describes; the other was written in the tenth century, and may have been influenced by the automata described in the *De Ceremoniis*, though if so the omission of all reference to the birds is curious. The earlier must be taken as the more reliable, but they do not contradict each other, and if we accept them both and combine them with the other evidence, we conclude that the original automata were built for Theophilus and destroyed by Michael; and that they were rebuilt in a new form many yeras later. We do not know exactly when this was, but the later automata are first heard of in two sources dating from the reign of Constantine VII, and it seems likely that they were rebuilt for him. Such description as we have of the two sets of automata, those of Theophilus and those of Constantine VII, is similar. The later setting, however, seems to have been quite new; there is no question in any reference to the earlier set of a "Throne of Solomon," or of these automata having formed part of it as the *De Ceremoniis* describes them.

We might reasonably suppose that both trees were the result of Byzantine study of Heron; the later one is contemporary with Heron of Byzantium. However, there is another possibility — that at least some of the influence came from the Abbasids. We know Theophilus' Palace of Bryas was built after models in Baghdad, and it has recently been suggested that all the automata were imported from Baghdad at this same time.[26] Abbasid influence might also have come from the visit of the Byzantine envoys to the court of the Caliph al-Mobarak at Baghdad in 917, which occurs in a great many Arab sources, all very similar, and all much later in date.[27] I quote here from Abulfeda's description of the Palace of the

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[25] Cedrenus, Bonn edition, p. 160; Zonaras, Teubner edition, IV, 8; Glycas, Bonn edition, p. 2492; Constantine Manasses, Bonn edition, p. 224 f.

[26] A. Grabar, "Le Succès des arts orientaux à la cour byzantine sous les Macédoniens," *Münchener Jahrbuch der bildenden Kunst*, III Ser., II (1951), 56. Further, Feldhaus, *op. cit.*, pp. 233–234, says that the Caliph al-Mamum had a gold and silver tree with singing birds, early in the ninth century. I have been unable to find any source for this statement.

[27] *Abulfedae Annales Muslemici*, ed. Reiske, II, 333. G. Le Strange translates al-Khatib's *History* in *Journal of the Royal Asiatic Society*, January 1897, pp. 35 f.; see also his *Baghdad during the Abbasid Caliphate* (1900), p. 255; Jacobstahl, *op. cit.*, p. 106, gives other Arab sources. The story is also referred to as mentioned in the Mir'at al-Zaman by E. W. Lane, *Arabian Nights* (1913), I, 345 f., note 91.

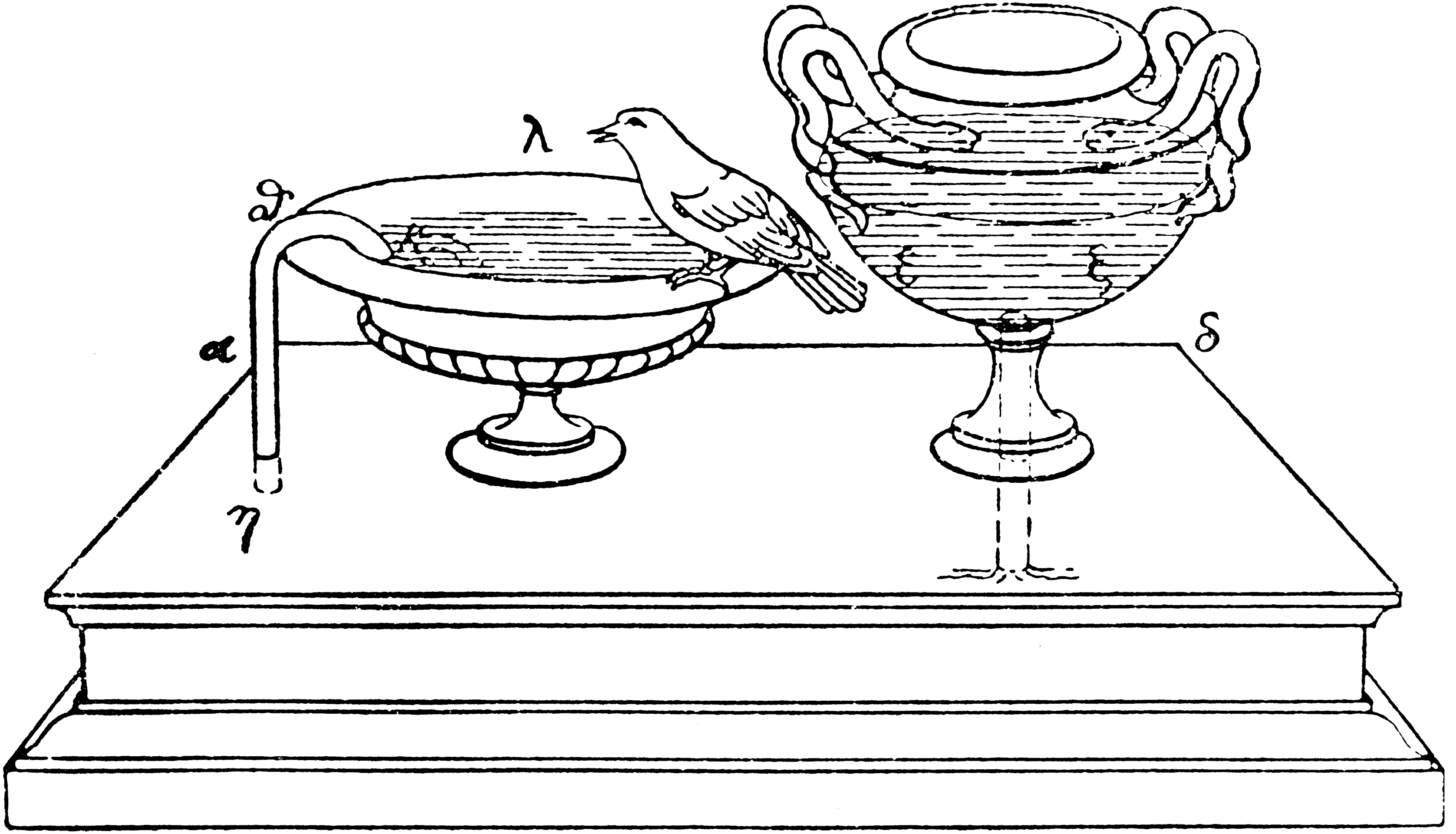

Fig. 1. Heron 1, 15, after Schmidt, *Heronis Pneumatica*.

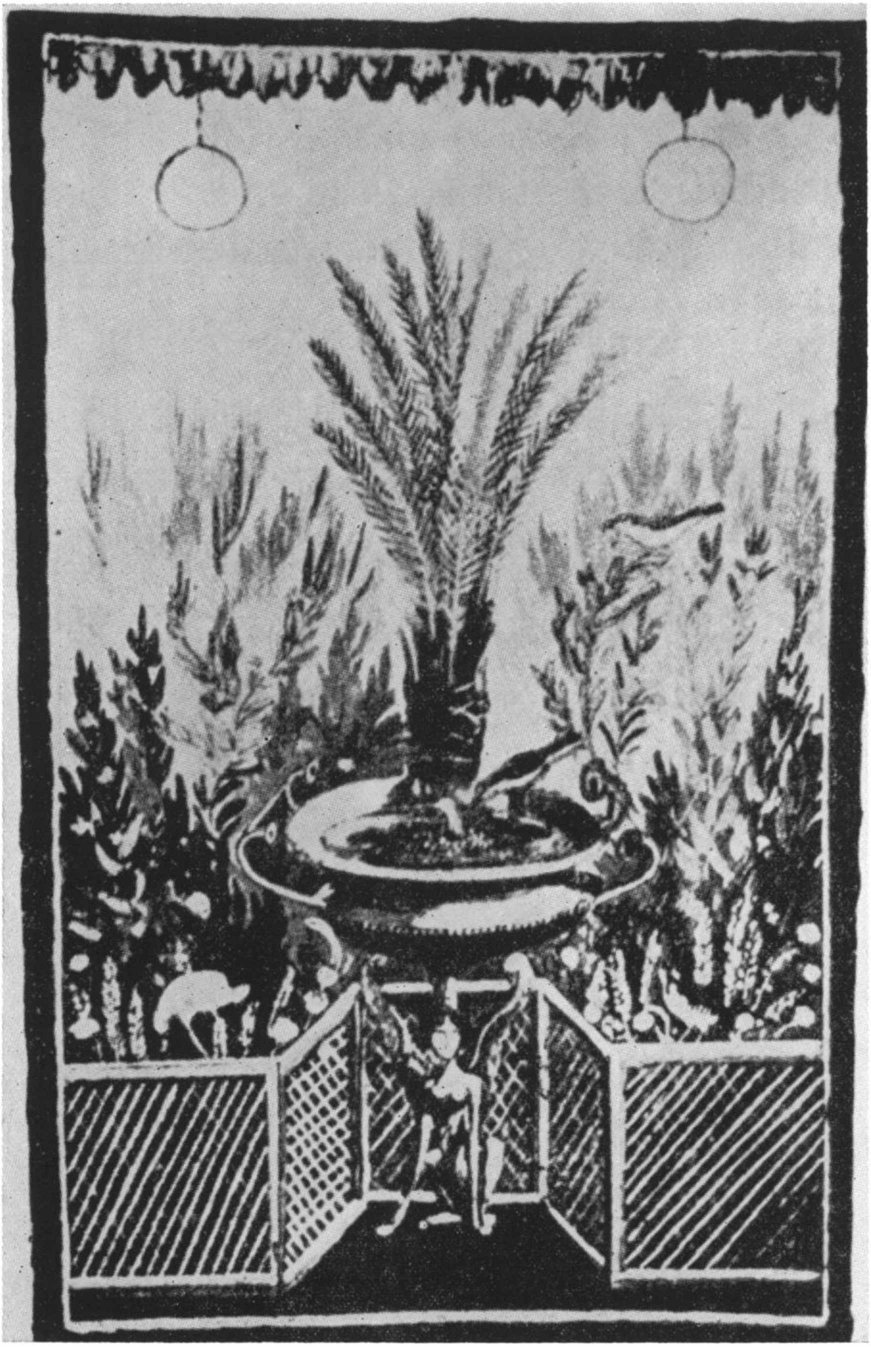

Fig. 2. Reconstruction of fresco in a house in the Via dei Soprastanti, Pompeii. After Feldhaus, *Die Technik der Antike und des Mittelalters*. See note 6.

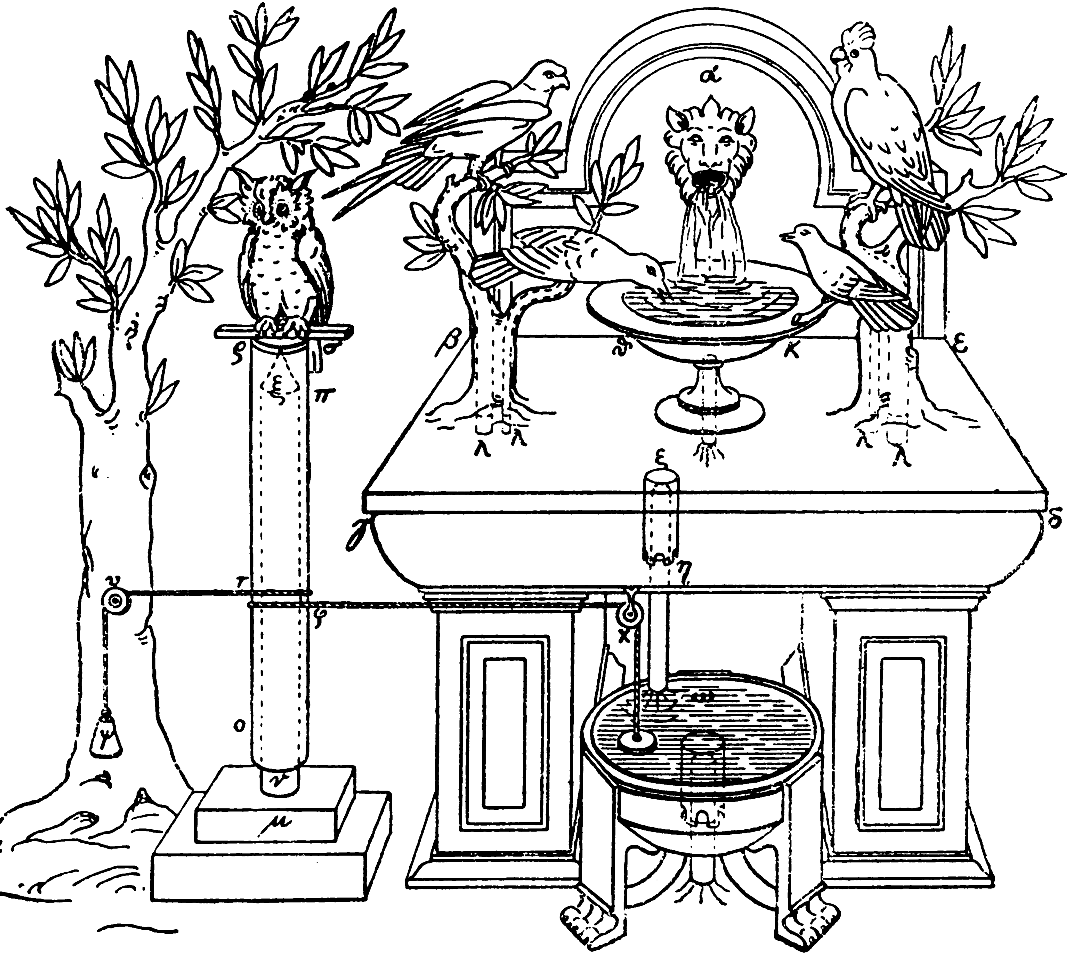

FIG. 3. Heron i, 16, after Schmidt.

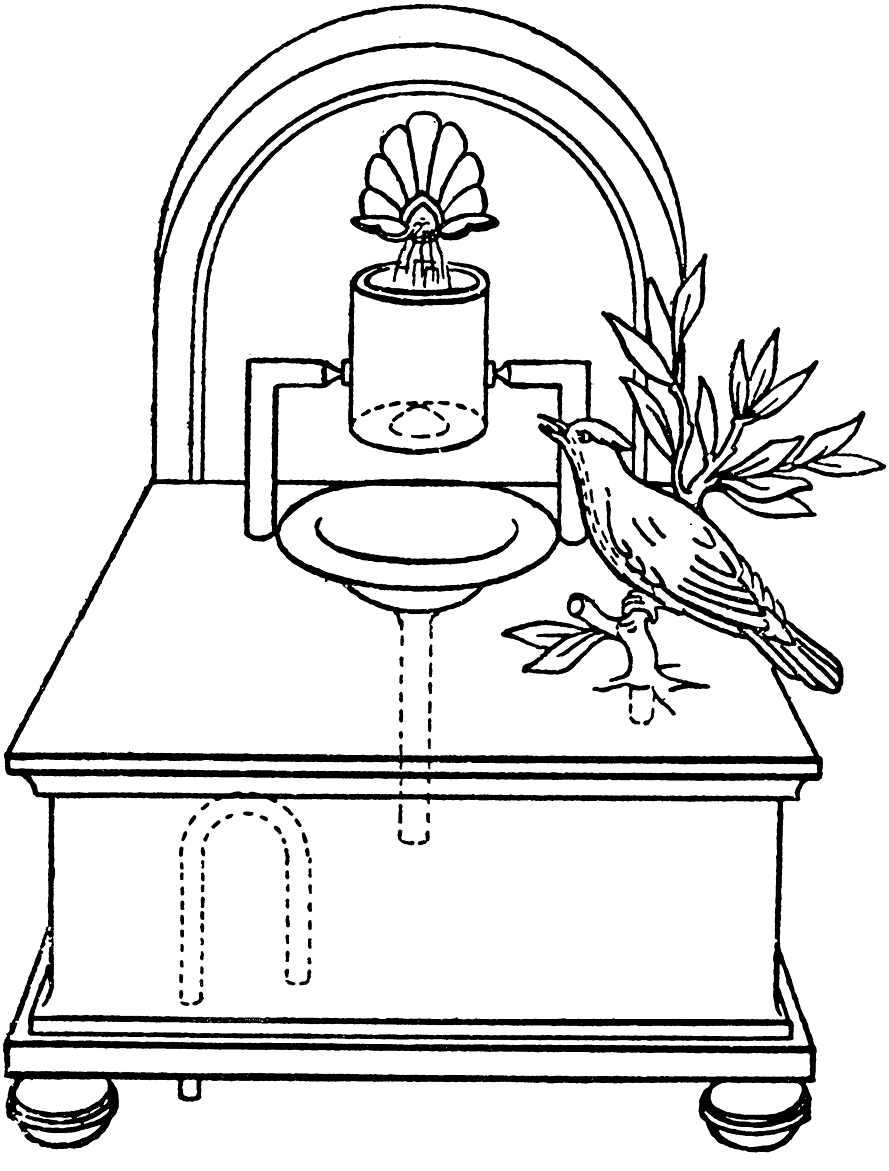

Fig. 4. Heron ii, 4, after Schmidt.

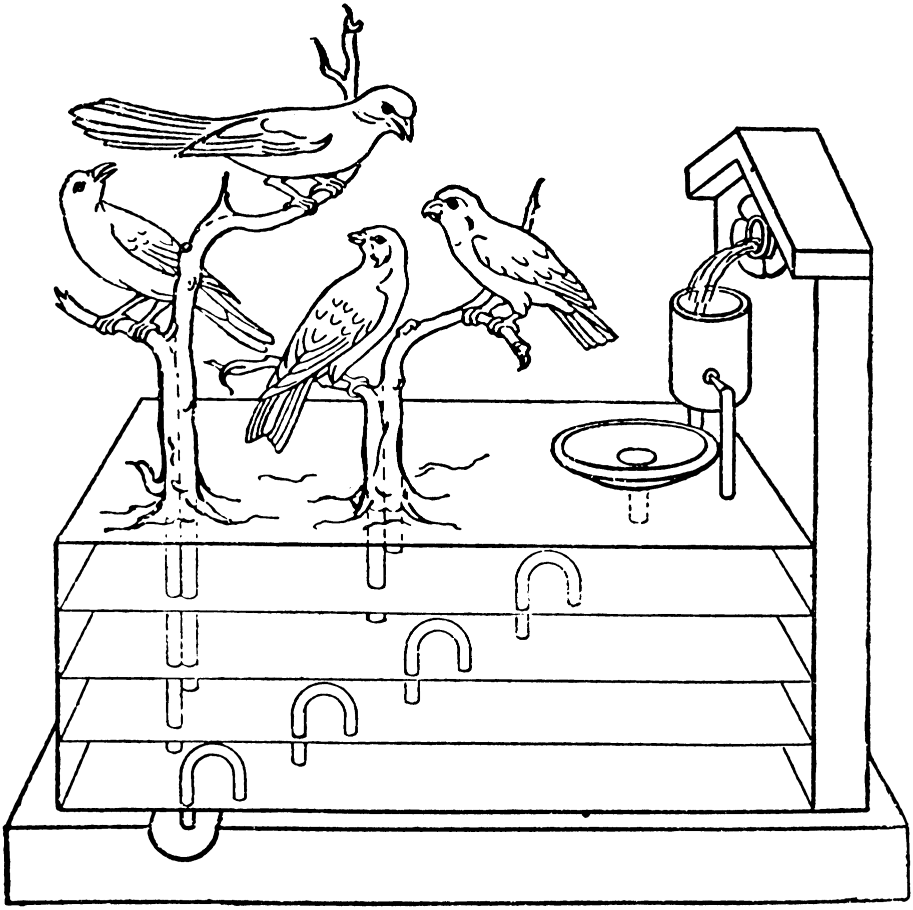

FIG. 5. Heron ii, 5, after Schmidt.

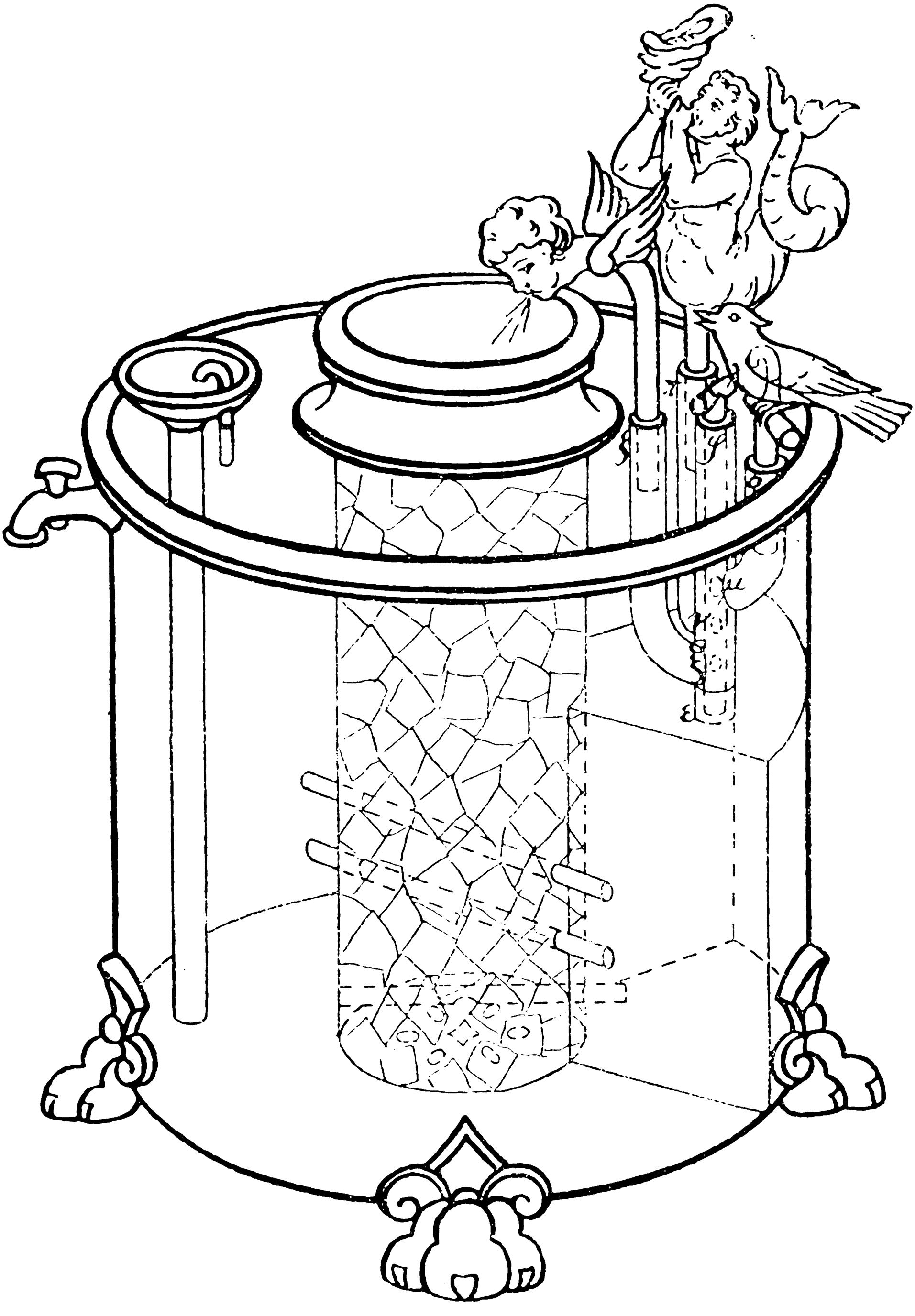

FIG. 6. Heron ii, 34-5, after Schmidt.

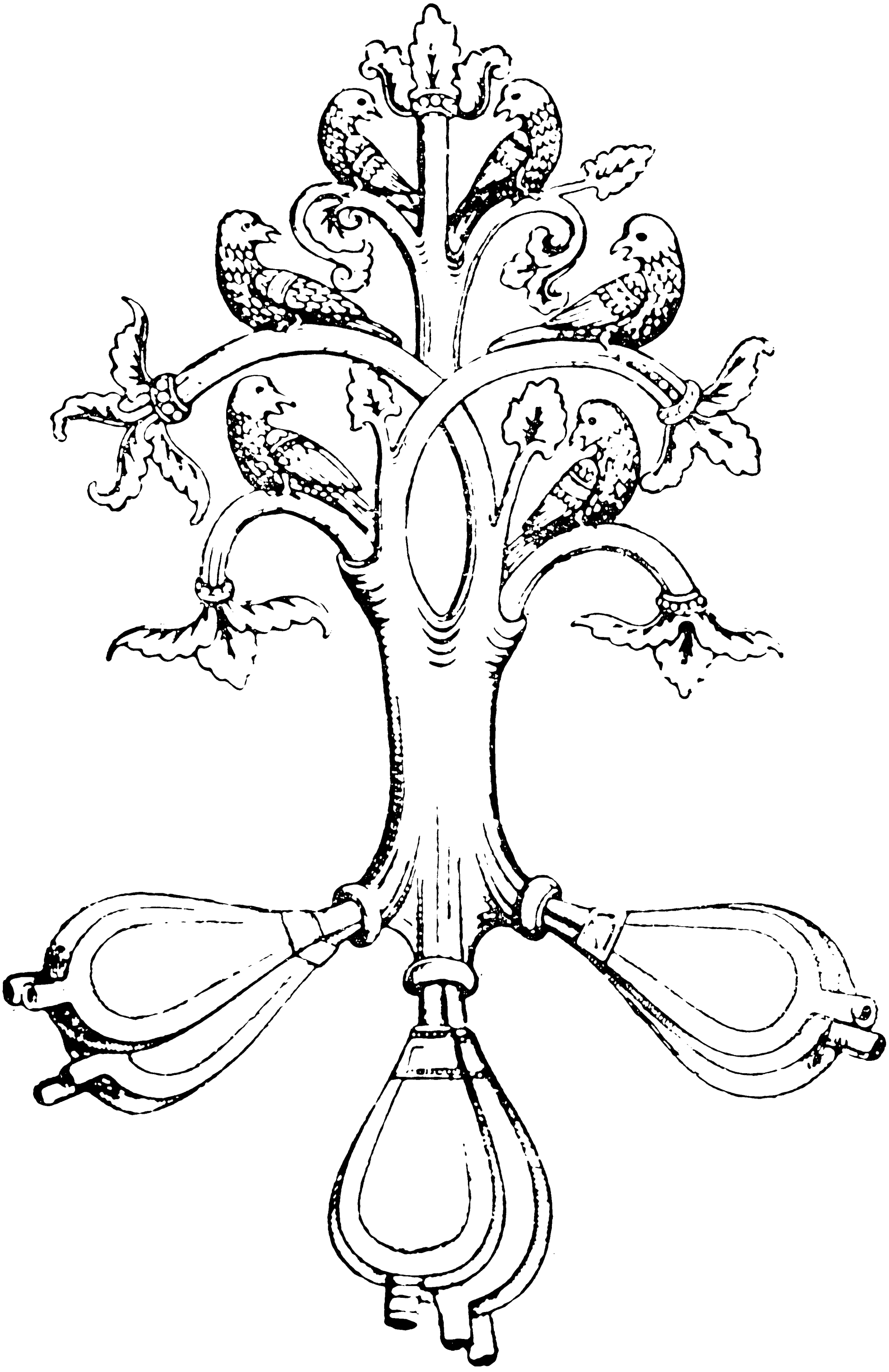

Fig. 7. The mediaeval mechanism, from a twelfth-century manuscript of Lamprecht, after Feldhaus.

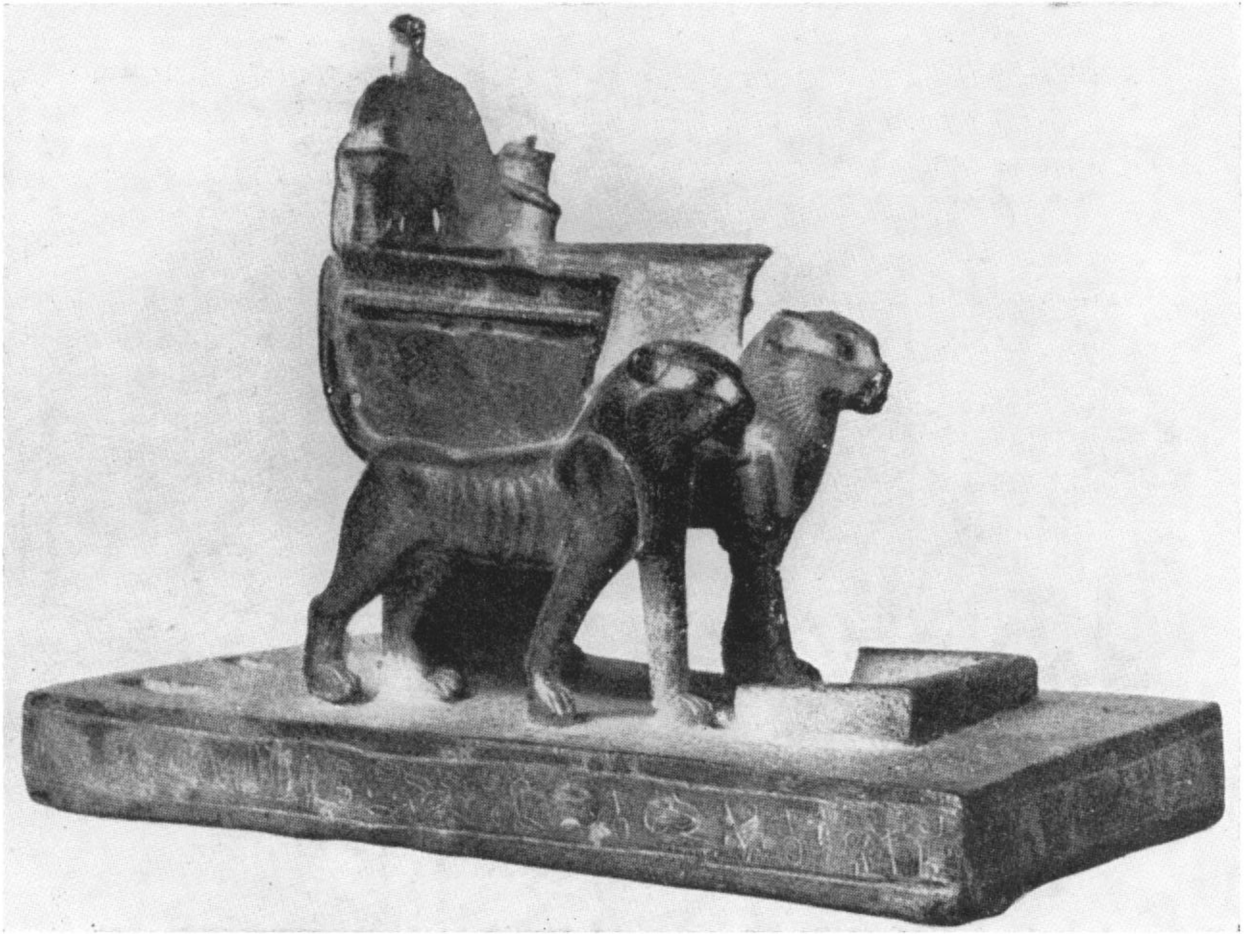

FIG. 8. Egyptian throne from Tell Moqdam, after Capart, *L'Art Egyptien, Choix de Documents*, IV.

Tree, which they visited: "Inter alia rari et stupendi luxus spectacula erat arbor aurea et argentea in octodecim ramos maiores diducta, per quos ceterosque minores ramulos utriusque formae sedebant aves, aureae et argenteae. Arbor haec foliis ex utroque metallo conflatis radiabat; et prout rami sese motitarent machinis acti, sic et aves certos et destinatos quaeque modulos recinebant."

The connection of the tree and singing birds with the throne seems to have been a tenth-century Byzantine adaptation, but it is remarkable that this automaton should appear in Byzantine history only twice, and that on the one occasion for which there are two pieces of contemporary evidence there should be a record of an example at the Abbasid court a few years earlier. Automata such as this must have been rare to receive this special notice, and it may be that the Ambassadors' reports of 917 provided the basic inspiration for the tree in the Magnaura, the memories of Theophilus' tree and native ingenuity working on the study of Heron the rest.

During the succeeding centuries the ornamental tree, with or without automata, was not confined to Byzantium and Baghdad. The singing birds are found in Greek popular romance, for instance the *Achilleis*,[28] and Ibn Hamdis describes an example in Arab Sicily.[29] Further, the tree spread both east and west. We find it near Samarkand in 1405. Clavijo describes a tree of the earlier type, that is to say, without automata, in a tent in the enclosure of Caño, the chief wife of Timur. It may be significant of the tree's movement from a more to a less sophisticated and ingenious court that though birds are described, they neither moved nor sang.

> In front of this small stand or table there was a golden tree, made to resemble an oak; with the trunk as big as a man's leg, from which many branches spread out in all directions, with leaves like those of an oak; and it was as high as a man, and overshadowed the table, which stood near it. The fruit of this tree consisted of rubies, emeralds, turquoises, sapphires, and wonderfully large pearls, selected for their shape and beauty. On this tree there were many birds, made of enamelled gold of various colours, which were seated on the leaves of the tree, with their wings spread out, and in the act of picking the fruit.[30]

A perhaps more legendary Asian example seems to be intended in the palace of the Old Man of the Mountains in Mandeville. The automaton he had in mind was without any doubt the same as those we have described, but he does not mention a tree, and this leaves us in doubt about its exact nature. There were here a number "of beasts and of birds that sang so delectably and moved by craft that it seemed that they were quick."[31]

Automata which may ultimately reflect the influence of the Hellenistic writers are mentioned further east, but the tree with the singing birds is not among them. The only other tree we hear of is the one William of Rubruck describes at the

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[28] I have been unable to verify either this reference, given in M. L. Gothein, *History of Garden Art* (1863), p. 141, or that in the next note.

[29] *Ibid.*, p. 149.

[30] Ruy Gonzales de Clavijo, *Embassy to the Court of Timur*, Hakluyt Society, Series I, XXVI (1859), p. 161.

[31] Early English Text Society, CLIII (1919), p. 185.

Mongol Court at Kambalu;[32] and such appearance of mechanism as there was depended on the concealment of a living trumpeter and of servants who poured liquids into hidden conduits. The purpose of this tree was the ornamental provision of four different liquids simultaneously — a parallel enlargement of the original tree image, again adopting methods used in another form by Philo and Heron, of which there were other mediaeval Asiatic examples.[33] Marco Polo speaks of "a large and very beautiful piece of workmanship" at the Mongol Court,[34] and Sir Henry Yule suggests that this was an automaton, but we have no idea of its details.

The western sources all belong to the North European world. Most of them describe the mechanism, which shows a significant alteration from that of Heron in that it consists of one or more pairs of bellows. The clearest description of the automaton and this new mechanism occurs in the original *Heldenbuch* in the story of Hugdietrich and Wolfdietrich. It is part of Wolfdietrich's adventure with the Mohammedan "Belgian" and his magician daughter, and the context is noticeable; this automaton is quite distinctly a piece of magical apparatus. The tree was a linden with seventy-two branches; like the tree itself the birds were of gold; they were hollow and when the bellows were worked they sang.

Da stund ain grune linden dort bi dem palast rich,
dar uff da sassen vogel, di sungen minniglich,
mit rotem gold gegossen und auch von edeln gestain
mit bernlin durch floriret, daz mniniglichen schain.

Wol durch den stam uffgingen zwelf roren rot goldein,
die gaben susse stimme vil manchem vogelin.
dar an zwen plasbelg waren gemacht mit ganzem flis
gar maisterlich beschlagen mit klarem silber wis.

Wann man di plasbelg rurte, daz gab in ouch sussen don
uff durch di guldein roren di vogel sungen schon,
di stimm kam in di vogel hin durch di roren hol,
daz iglichs gab sin done und sungen alle wol.

Ain tafel rich von golde under der linden stund
mit roten gold beschlagen, daz lobt des fursten mund,
mit wissem helfenbaine gar wol durchgraben was.
dar ob wol tusent ritter mit gutem raume sas.

Und wan der kunig riche da hin zu tische ging
mit sinem hofgesinde und an zu essen fing,
er lis di sinen ruren di belge sa zu hant,
so sungen schon zu tische di vogel alle sant.

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[32] Hakluyt Society, N.S. IV (1900), 207–209. An adapted drawing of the tree is reproduced from the original by Pierre Bergeron in Gothein, *op. cit.*, fig. 101.

[33] Heron, i, 22; Philo, 25; Drachmann, *op. cit.*, pp. 60 f. Cp. al-Jazari, Wiedemann-Hauser, *Der Islam*, VIII (1918), 77 and fig. 10. Asiatic examples are mentioned by Odoric (Hakluyt Society, N.S. XXXIII (1913), 222 and 258) and by Mirkhond (I copy this reference from the Hakluyt Society's William of Rubruck, p. 208), more modern ones by Jacobstahl *op. cit.*, p. 106, note 18, and Bretschneider, *Recherches Archeologiques* (1879), p. 49.

[34] Sir Henry Yule, *Book of Ser Marco Polo* (1903), I, 382 and 385, n. 3.

> Man blis dort bi der linden die plasbelg uber al,
> sich hub von vogelstimmen ain wunniglicher schal,
> si sungen susse done wol an der selben stunt.
> Wolfdieterich der spise nie nam in sinen munt.[35]

Despite the fact that the bellows are usually referred to, and presumably were fully visible, the magical flavor is evident throughout these European examples. It refers sometimes to the placing and use of the automaton,[36] sometimes more generally to the scene as a whole.[37] It perhaps reaches its height in Lamprecht's *Alexander Song.*[38] Lamprecht describes a magnificent gold stag in a royal palace. The stag had a thousand horns with a bird on each, and below were twenty pairs of bellows each worked by twelve strong men. When they blew, the air passed out through openings above, the birds sang, a man seated on the stag blew his horn, his dog barked, and the mouth of the stag emitted a sweet scent. One of the later texts of the *Alexander Song* illustrates the mechanism of this (Fig. 7).

There is less to say about the other automata mentioned in the *De Ceremoniis.* They are the lions that roared, and the beasts by the side of the throne that stood upright. The lions go back to the description of the original throne of Solomon in I Kings and later in II Chronicles, and in view of its name are a basic feature of the Byzantine throne also.

> Moreover the king made a great throne of ivory, and overlaid it with the best gold.
> The throne had six steps, and the top of the throne was round behind: and there were stays on either side on the place of the seat, and two lions stood beside the stays.
> And twelve lions stood there on the one side and on the other upon the six steps: there was not the like made in any kingdom. (*I Kings,* x, 18–20)

The passage in Chronicles is almost identical, save for the introduction of "a footstool of gold," which may be the first stage in legendary accretions to the original.

The Old Testament description is the basis of that in Josephus.[39] As often happens, his version is slightly more wonderful than the original from which he drew: *εἰργάσατο, δ’ἐξ ἐλέφαντος θρόνον παρμεγεθέστατον ἐν κατασκευῇ βήματος, ἔχοντα μὲν ἓξ ἀναβαθμούς, ἑκάστῳ δὲ τουτων ἐξ ἑκατέρου μέρους δύο λέοντας ἐφειστήκεσαν, τοσούτων ἄνωθεν ἄλλων παρεστώτων.*

In a later stage of the legend appears the Arab contribution. The throne was used as a Judge's seat, and when a question was put the lions roared and compelled the person questioned to tell the truth.[40] This story, the date of which is uncertain, is strikingly like the procedure described in the *De Ceremoniis,* and is the first mention of the lions roaring. This is all the *De Ceremoniis* describes them as doing, but Liutprand enlarges with "verum auro tecti leones quasi custodiebant, qui cauda terram percutiebant, aperto ore, linguisque mobilibus rugitum emittebant." If further proof were needed that it was the Byzantine automata that influenced the West, it lies in the fact that roaring lions are to be found there in addition to singing birds.[41]

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[35] I. V. Zingerle, *Germania,* vii (1862), 101. The later version is in F. H. von Hagen, *Heldenbuch* (1855), i, 233.

[36] See Zingerle, *op. cit.,* and H. R. Massmann, *Eraclius,* pp. 217 f. The majority of the sources are collected in these two places.

[37] O. M. Johnston, *Zeitschrift für romanische Philologie,* xxxii (1908), 705 f. Cp. also the relevant passage in the *Life of St Brandan.*

[38] Zingerle, *op. cit.,* p. 108.

[39] Josephus, *Ἰονδαικῆς Ἀρχαιολογίας,* viii, 140 (Teubner edition, ii, 198–199).

[40] J. P. Migne, *Dictionnaire des Apocryphes,* ii (1853), 844–845, giving the earlier sources.

But on this occasion no attempt is made to describe how the roars, or Liutprand's lions' tails, which "terram percutiebant," were produced. We are, in fact, in the dark about the working of all these automata, and no Byzantine writer makes any attempt to describe it. It was not relevant to the purpose of the *De Ceremoniis* to do so, and the most the others can offer is Symeon's phrase about the birds. The case with the Abbasids is similar. No writer goes even as far as the general sense of Symeon's phrase — indeed Abulfeda's reference to "machines" is as far as we get, and it is of little help. It is only in the West that we hear anything of the mechanism of the tree and the singing birds, and here it is a pair of bellows. The Western sources must be supposed to reflect examples of the tree nearer home than Byzantium. If so, we should like to know the degree to which these trees depended on the Byzantine one and, in particular, who made the change from compression by water to pressure by bellows — the Abbasids, the Byzantines, or the West?

It seems unlikely, on the face of it, to have been either of the first two, in view of their study of Heron. But the phrases used about these automata by writers of either country would apply equally well to either principle of air compression. Further, and referring to the Byzantine Throne of Solomon itself, the tree is incompatible with what Heron describes, and the only need he mentions for the automata of the singing birds is running water. This is unlikely to have been available in the Triclinium of the Magnaura, and is not referred to by any of the Byzantine authors, though it is mentioned by the Abbasids. Again, if the lions stood at the sides of the throne, as Liutprand implies, how was the roaring — likely to have been produced by similar methods — managed if not by bellows, and how could the working of either automaton be timed to the exact moment of the logothete's questions in any other way? Yet again, if we read the *De Ceremoniis* as meaning that there were two sets of birds, one in the tree or trees, the other in the throne, how else did the second one work? The mention of the automaton of the birds in Theophilus' Palace is very brief, but is consistent with either method of compression, though the probability of Symeon's phrase being intended to refer to the Heronic method seems very slight. This is not the case with the Throne of Solomon, and we cannot avoid the conclusion that whoever altered the setting of Heron's automaton of the birds altered the mechanism at the same time.

The third automaton, that of the moving beasts, is even more of a mystery. Neither Liutprand, Georgius Monachus and his followers, nor any of the non-Byzantine sources mention it or anything of the kind. The *De Ceremoniis* describes what the beasts did, but not what they were like. The Continuator and his later followers, with reference to the throne of Theophilus, describe them as gryphons, but not as making any movements. What the *De Ceremoniis* describes does not sound like an automaton in the same sense as the other two, i.e., as something that could work by either of the methods of air compression. They are said to have been ἐν τῷ θρόνῳ, and we must wonder if they can have been connected with the movement of the whole throne that Liutprand describes.

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[41] Zingerle, *op. cit.*, pp. 106–107.

How, then, are we to visualize the Byzantine Throne of Solomon? The tree with the birds stood in front of it; the lions were beside, as though guarding it; the beasts were "in the Throne." The answer seems to be an upright throne, with or without a back — examples of both types occur in Middle Byzantine manuscripts and there is one of each on the Hagia Sophia mosaic panels — and with side supports of animal figures in the round. The most common type of "animal throne" is that with lion legs; it dates back at least as far as the throne of Tutankhamuen, and is well known in later antiquity.[42] The type incorporating complete lion figures is more rarely met with. The earliest we know is the original throne of Solomon, with lions in two groups, one beside the seat, the other on the steps, and apart from the throne proper. A few later pieces resemble our description of the Byzantine throne more closely. A late fifth- or fourth-century Hellenic relief of Cybele, which before the Second World War was in Berlin, showed a lion lying beside her throne.[43] There are closer parallels from Egypt. In Egypt the lion was associated with Horus, and so, by extension, with royalty itself; this explains the commonness of the throne among finds from Egypt as compared with other countries, and may perhaps give a clue to one of the sources of Byzantine inspiration, coming through an Arab intermediary rather than direct. A group of small Egyptian bronzes of thrones, dated to the second century B.C., has been found at Tell-Moqdam; five of them were formerly in the Fouquet Collection.[44] One of these is an upright throne with a back, and with a pair of standing lions "as though guarding it" (Fig. 8). This, though far removed in time from Constantine VII, is close to what he describes, and an Egyptian throne may be a prototype. An alternative design of lion throne, much closer in date, appears on the silver disk of Aspar, who was consul in A.D. 435, but here the figure sitting on the throne prevents our even being sure that the lions were complete figures. It is, in fact, very difficult to form a clear mental picture of the Byzantine Throne of Solomon, and both date and source of its original introduction to the Byzantine Court are disputed.[45] None of the imperial furniture remains, however, or is likely to be found in excavation. In its absence we are reduced to conjecture.

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[42] H. Carter and A. C. Mace, *The Tomb of Tutankhamun* (1923), I, pl. lxii; G. M. A. Richter, *Ancient Furniture* (1926), figs. 23, 275 f.

[43] Richter, *op. cit.*, fig. 40. For similar examples see *Die Antiken Terrakotten*, ed. R. Kekule von Stradonitz, III²; Franz Winter, *Die Typen der Figurlichen Terrakotten* (1903), p. 175, 1 and 2.

[44] P. Perdrizet, *Monuments Piot*, XXV (1921–22), 355 f. Two of the bronzes are reproduced in Jean Capart, *L'Art Egyptien, Choix de Documents*, IV (1949), pl. 794.

[45] Grabar, *op. cit.*, p. 56, n. 39.